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Nudibranchs
Environmental Factors Affecting Fluorescent Pigmentation
Metal Halide Spectral Analysis

photograph by Mikel Cortés Escalante

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ADVANCED AQUARIST'S ONLINE MAGAZINE

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ANNOUNCEMENT

Advanced Aquarist to be Made Available in PDF Format!

By Shane Graber

Our magazine issues from November 2007 and forward will be available in both an online AND downloadable PDF format for your added reading enjoyment. Read more for the details!

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Just as we were the first to introduce a 100% web-based reefkeeping magazine back in 2002, we continue to innovate by introducing a new way for you to read *Advanced Aquarist* — in PDF format! We are excited to announce that in two weeks time, we will be making downloadable PDFs available for the November 2007 issue and future issues of *Advanced Aquarist*. This project has been in the making for almost a year and a half and was undertaken due to numerous requests for downloadable PDFs of the magazine from readers. You've asked for it, we heard you, and we worked hard to provide you, our readers, what you asked for.

Starting December 1st you will be able to download *Advanced Aquarist* in PDF format. You will get a full color, fully searchable document that looks great printed, and that you can take wherever you go. We've implemented a design that's clean and easy on the eyes as well as printer ink. *Advanced Aquarist* is confident you will find the PDFs an invaluable addition to our magazine.

The Design

Our layout inspiration for the magazine has come from the PDF versions of technical journals like *PLoS Biology* as well as proven magazine layouts such as *Discover Magazine* and *Scientific American*. The magazine cover has been completely redesigned and now features a full-page cover photo plus highlights of select content from within each issue. The table of contents at the beginning of the PDF will be internally linked so that you can click on an article title, taking you to that article page in the PDF. Each issue will be roughly 30-45 pages in length and will support hyperlinks throughout the article so that you can click through the issue as well as click on links for other websites. The download size will be somewhere between 6 MB and 12 MB depending on the content inside each issue.

File downloads and podcasts will not be included in the PDFs. However these will be linked from the article so that you can download them from our website at your leisure.

We've put together a preview of a magazine article that showcases what you can expect when published on December 1st. Download it to see how it will look once available!

The Details

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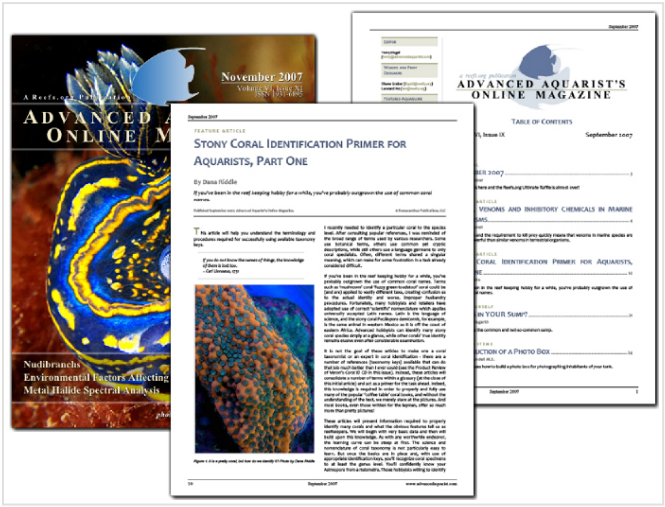

Background and Future Plans

PDFs will be available for free until September 2008's issue, at which point *Advanced Aquarist* will decide on how the PDFs shall be distributed. Producing a magazine in this format is time-consuming and is not free, but we have chosen to provide a year's worth of free downloads for everyone to enjoy and appreciate this new medium. Future issues may include sponsor ads and product announcements to help defray the publication costs as well as to inform you of new and exciting products from marine hobby manufacturers. As this project progresses, other changes to the format and layout may take place in order to better optimize the magazine. Currently, there are no plans to make our back issues available as PDFs.

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We've put a lot of time and energy into this project and we hope that you enjoy it. See you on December 1st!

EDITORIAL

November 2007

By Terry Siegel

Tank maintence is a necessary task.

Published November 2007, Advanced Aquarist's Online Magazine.

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I just finished a too long needed maintenance on my reef tank. It was getting to the point where there was so much coralline algae growing on the front pane that visibility was seriously compromised, and to make matters worse I was unable to enjoy looking at my captive critters. My reef tank was fast becoming an unweeded garden so to speak. I also knew that I would have to spend the good part of a day, and didn't really want to. I'm sure that many reef keepers out there have had similar feelings. Sometimes it seems to me that I have spent a good part of my life doing tank maintenance, and for almost 60-years.

First, I had to empty the canister that holds my activated carbon and "Phosguard." Once cleaned out I added a layer of new carbon, followed by a layer of Phosguard^{tm,} and that followed by another layer of carbon. With that back on line I turned to my two large skimmers, where even though the skimmate is collected in external canisters, the inner walls of both skimmers had about 3/8 of an inch of muck clinging to them. Using a plastic spatula I collected about a gallon of this muck/detritus, which I then saved for use as fertilizer for my terrestrial plants. I, at this time, checked the ozonizer, which I use to inject ozone into one of the skimmers. With the skimmers cleaned they were put back on line. Incidentally, these two skimmers process about 4,000-GPH.

Next comes the coral gardening; that is, trying to keep various animals from stinging one another as they grow. There was a time when I was thrilled to see *Acroporas* grow, but now I'd like to slow their growth down. Fortunately, I no longer have to concern myself with invasive anemones, like *Manjano* sp. and *Aiptasias*. My double saddle back butterfly (*C. ulietensis*.) has completely eliminated them. I have heard from a reef keeper who insists that the butterfly that I have is really a *C. Falcula*. These fish look a great deal alike so I'm not sure who is correct. In fact, they could be morphs of the same species.

Finally comes the part that I really dislike: cleaning coralline algae off of the 8x3-foot acrylic front pane. Over the last few years I have constructed various tools that will both remove the algae but not scratch the plastic. It does take several hours - even with my various gadgets - and usually I manage to add a few new scratches despite my best efforts. A company called EverClear has send me equipment to remove these inevitable scratches. I do plan on writing up a review of this well made equipment. So far, I have used their stuff on the outside with great success, but the real test will come when I try to remove the ones inside, under water.

Finally, it's all done, and I can step back and really enjoy the tank again. Slowly, all of the fish come out from hiding and life in my captive reef returns to normal. In fact, it looks so good I grab my camera and take some new pictures, which are shown here. The numbers on one of the pictures tells how long that particular animal has been with me.

FEATURE ARTICLE

Coral Coloration, Part 8: Blue and Green Coral Fluorescence: Environmental Factors Affecting Fluorescent Pigmentation

By Dana Riddle

For our purposes, we'll say that blue and green fluorescent pigments are in the range of 400nm to 565nm.

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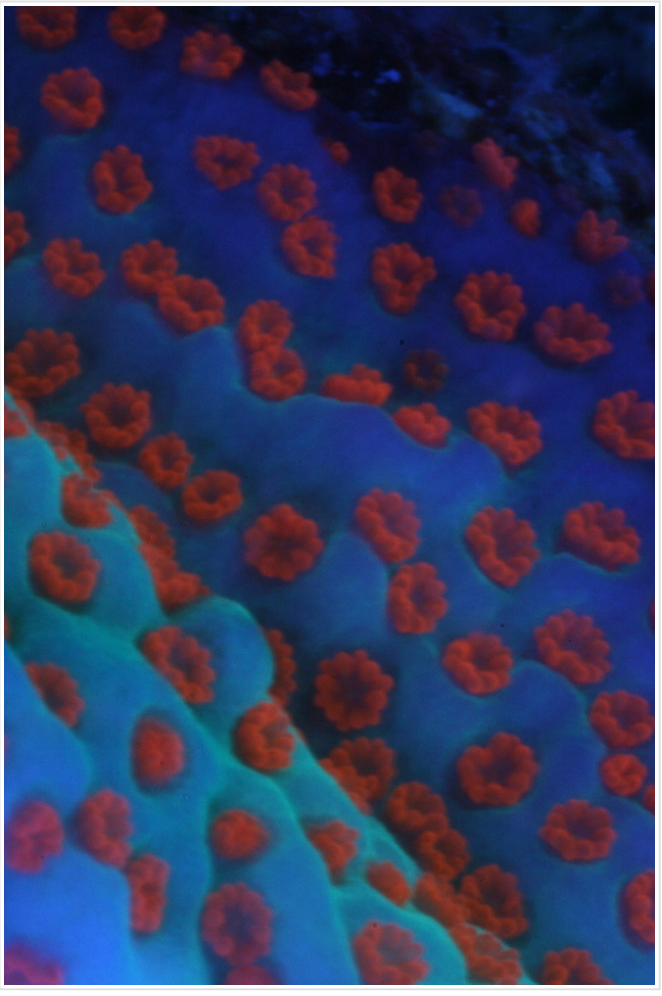
In Part 7, we examined some environmental factors that can affect coral non-fluorescent chromoproteins. Also presented was the concept of light reflectance and how corals generally fall into either 'brown' or 'non-fluorescent blue' coral modes (although it seems apparent that light intensity - particularly 'blue' light - can promote the transition from one state to the other).



This time, we'll look at those factors known to influence corals' 'blue' and 'green' fluorescent pigments. For our purposes, we'll say that blue and green fluorescent pigments are in the range of 400nm to 565nm. There are at least 66 described pigments in this category; in reality there are probably hundreds (see Part one of this series for a listing of fluorescent pigments www.advancedaquarist.com). We will also observe how fluorescence can impact our perceived coloration of two coral specimens.

Terms

A review of terms is probably in order before we begin our discussion.

Fluorescence. Fluorescence is a phenomenon in which a material absorbs light of one color (wavelength) and emits it at a different color (wavelength). Absorption occurs when an incoming photon (light particle) causes an electron to move from a stable ground state to a higher energy, unstable excited state. One of the ways for the excited electron to return to the ground state is to 'jump' back down, emitting a photon of light. There is always some energy lost to heat in the process, so the emitted photon has less energy than the original photon. The energy of a photon is related to its wavelength, which we perceive as color - higher energy corresponds to shorter wavelengths, lower energy to longer wavelengths.

Emission spectrum. The emission spectrum is a measurement of the emitted energy as a function of wavelength. It is generally presented as a graph (see Figure 1). The spectrum will have a maximum but may also have secondary peaks, called **'shoulders'**. In text the spectrum is often described by the wavelength of the emission peak. Some emission spectra cover a broad range of wavelengths, while others are quite sharp. This is described by the Full Width at Half Maximum (FWHM), the spectral width in nanometers at the level that is 50% of the value at the peak. The emission spectrum can be measured with a basic spectrometer like the units from Ocean Optics.

Excitation spectrum. The excitation spectrum is a measurement of the relative ability of different wavelengths of light to stimulate (excite) the fluorescence. Like the emission spectrum,

the excitation spectrum will have a maximum but may also have secondary peaks. The excitation spectrum tells you what wavelengths of light will be good at making that particular substance fluoresce. Unlike the emission spectrum, the excitation spectrum is difficult to measure without specialized, expensive instrumentation. To make the measurement you have to vary the wavelength of the incident light in very fine increments and measure the fluorescence response at each one.

Fluorescence lifetime. Fluorescence is short lived - once the excitation wavelengths are absent, fluorescence decays in a fraction of a second (billionths of a second), and the phenomenon ends.

Determining Fluorescence

For practical purposes, any pigment that 'glows' under an excitation source (usually a 'blue' actinic lamp or high kelvin metal halide lamp) is considered fluorescent (Be aware that some non-fluorescent proteins may appear as a 'flat' blue or purple-blue when viewed under these light sources). Fluorescent pigments are generally readily apparent and identifying them is usually quite easy when using a fiber optic spectrometer - spikes not due to the spectral signature of the lamp are fluorescence!

However, we must exercise care when analyzing these signatures and understand the spectral quality of the excitation light source.

A 'backlight' was used to excite all fluorescent pigments reported in this article. Figure 1 shows the spectral signature of the 'common' backlight where the output is largely in the ultraviolet range (and thus invisible to the human eye). Note that there are two broad bands of visible light at 400-408nm (violet) and 429-439nm (violet-blue). Therefore, we must be especially careful when analyzing fluorescent signatures and not mistake spikes in these two ranges as that of fluorescence - they could well be mere reflections of the excitation source.

Blue Fluorescence and Light

Our broad definition of 'blue' fluorescence includes those corals exhibiting violet fluorescence, blue fluorescence, blue-green fluorescence and green-blue fluorescence.

While the generation of non-fluorescent chromoproteins seems, in many cases, to be linked to light intensity/quality, it may seem surprising that blue fluorescent corals are most abundant at deeper depths. They comprise about 42% of the total number of fluorescent coral colonies found at depths greater than 10m on the Great Barrier Reef (Salih, 2003 - see Figure 2).

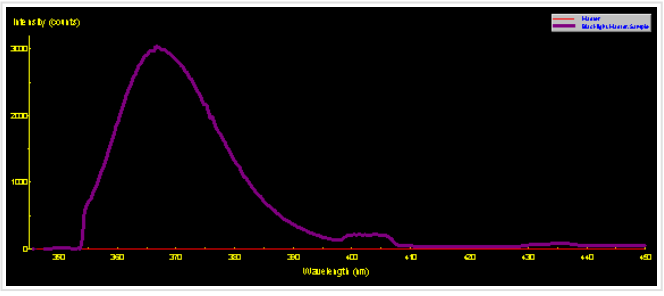


Figure 1. The spectral signature of a common black light (Wal-Mart variety). Besides the ultraviolet spike at ~365nm, there are two 'shoulders' in the visible portion of the spectrum.

What, if anything, does this information tell us? It certainly seems to suggest that blue fluorescence could be a trait of deeper-water corals. That blue fluorescence is found in shallow water could mean little - perhaps corals there are shaded, live in crevices, etc. - Shallow water does not always equate to high light intensities!

PAM fluorometry (a 'photosynthesis meter') shows us that the Superman *Montipora* does not require a great deal of light and will in fact bleach when exposed to 300-400 µmol·m²·sec during a photoperiod of 11 hours (Riddle, in press).

Blue Fluorescence of the 'Superman' *Montipora*

Parts 1 through 6 examined the known pigments found in marine invertebrates. After scouring hundreds of references, I felt fairly confident that the planned spectrometry work would find coral pigments that had been previously described. I was in for a rude awakening. The very first fluorescence analysis revealed at least 3 pigments that, to my knowledge, had never been reported before in corals (see Figure 3 for the fluorescence of the 'Superman' *Montipora*).

Blue fluorescence peaks at 487nm (P-487 has been noted only in Caribbean corals - this is the first report of this pigment in a Pacific coral). Also note the strong fluorescent spike at 611nm (this is the first report of this pigment in a coral).

Green Fluorescence

Green fluorescence is perhaps the most common of all coral fluorescent pigments (hundreds of corals contain one of more of the 45 or so described 'green' pigments).

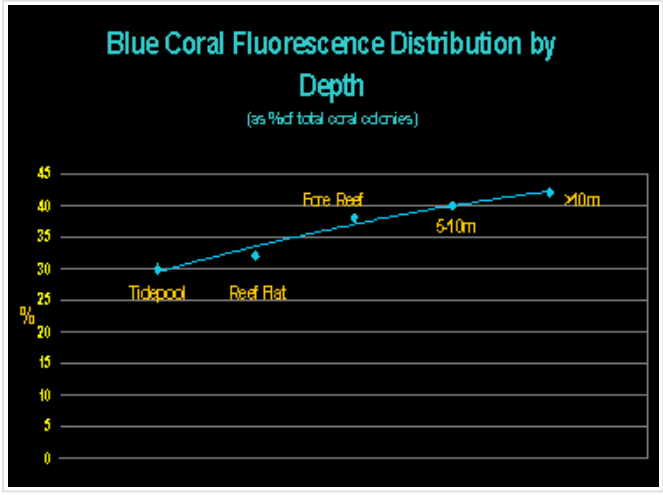


Figure 2. Salih's 2003 data suggests blue corals are most common at deeper depths.

Effects of Fluorescence on Perceived Color

Fluorescence can, in some cases, determine the apparent coloration of a coral. The example in Figure 7 demonstrates that a green fluorescent pigment can become the dominant pigment, thus 'over-powering' the coral's reflectance (see Figure 6 for a photo of this *Montipora*).

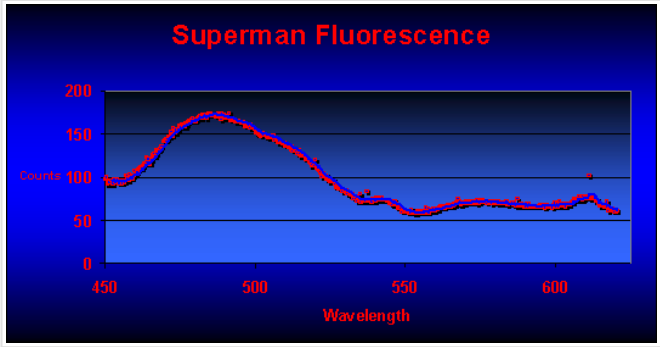


Figure 3. Fluorescence of the Superman Montipora (seen in the introduction photo).

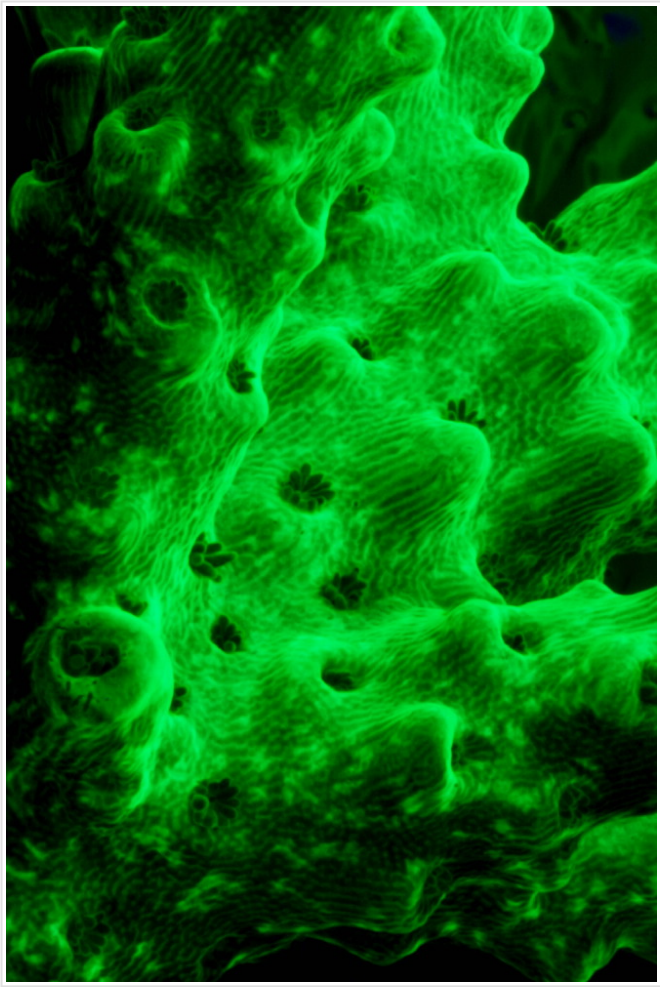


Figure 4. The green fluorescence of the 'Bali Slimer' Acropora.

The fluorescent pigment does not always determine the apparent color of a coral. For instance, Figure 8 is the reflectance of a 'Purple Monster' *Acropora*. The reflectance signature is clearly that of a 'blue' coral (see Part 7 of this series for an explanation of 'brown' and 'blue' coral, if necessary). There is a minor contribution of green fluorescence peaking at 515nm (apparently the same pigment seen in the Montipora in Figures 6 and 7). However, the green pigment fluorescence is not strong

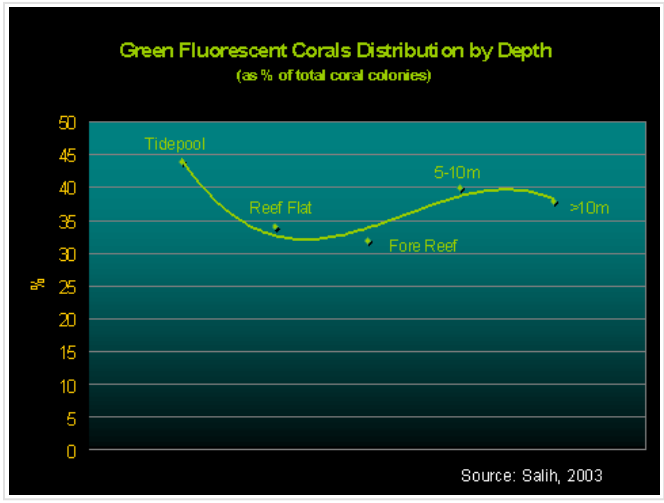


Figure 5. There seems to be no real correlation between depth and corals displaying green fluorescence.

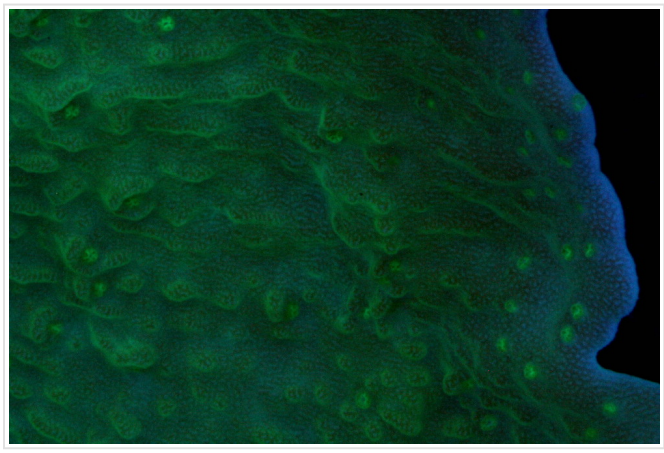


Figure 6. This Montipora's green fluorescence is most apparent in the polyps.

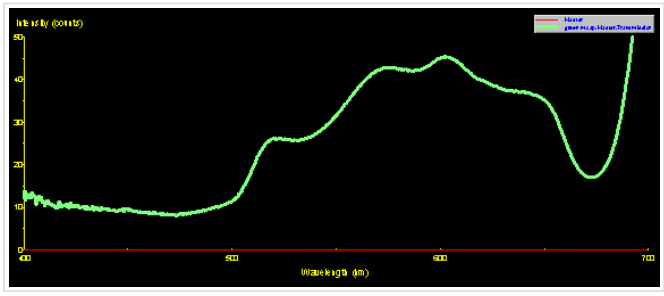


Figure 7. Green Montipora reflectance - its spectral signature falls into the 'brown' coral category, but fluorescence peaking at 515nm makes the coral appear green.

enough to make the coral appear green under full-spectrum lighting (it is, of course, purple).

Temperature

Fabricius (2006) reported that dark corals absorb more heat than brightly colored corals.

This is a most interesting report - but is her observation applicable to reef aquaria? Evidence suggests it is - darker (zooxanthellae brown) corals can, under certain conditions, absorb heat and become warmer than the surrounding water. In general, reef aquarists are advised to keep water temperatures in the mid-to-high 70°F range. When using metal halide or mercury vapor lamps, it is possible for coral skeletons to act as heat-sinks and actually become slightly warmer than the ambient water temperature. This rather disturbing news (especially for those corals maintained in aquaria teetering on the edge of acceptable upper-scale temperatures) is discussed by Riddle, 2006 (see www.advanceaquarist.com/2006/2/aafeature2).

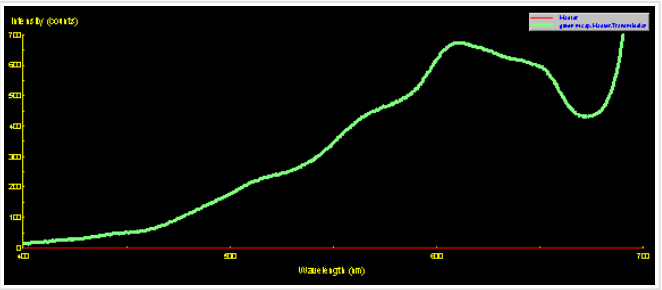


Figure 8. 'Purple Monster' Acropora reflectance - it is a category 'blue' coral (due to the presence of at least one non-fluorescent chromoprotein) with minor contribution of broadband green fluorescence. When viewed under broadband light sources, the green fluorescence plays little part in our perception of this coral's coloration.

Next time, we'll look at orange and red coral fluorescence and how they are distributed by water depth, and examine if some pigments are *really* photoprotectants.

Post Script

Those interested in discussing coral coloration can contact me at RiddleLabs@aol.com.

The Atlanta Reef Club will host the Marine Aquarium Conference of North America (MACNA) in September 2008. See www.masna.org for details.

Many thanks to Steve Ruddy (www.coralreefecosystems.com) for his assistance in gathering data.

References

1. Fabricius, F., 2006. Effects of irradiance, flow and colony pigmentation on the temperature microenvironment around corals: Implications for coral bleaching. Limnol. Oceanogr., 51(1): 30-37.

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FEATURE ARTICLE

NUDIBRANCHS: BEAUTIFUL BUT DANGEROUS MARINE CREATURES

By Mª Victoria Bengoa Ruigómez

They are considered the most beautiful creatures of the sea and as they move very slowly, they are very popular among submarine photographers.

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In 1943 Jacques-Yves Cousteau used aqualung on French south coast for the fist time in the history. From that very moment, both scientists and divers were able to admire and discover the wonders of the sea, unachievable for them until then. Among the fascinating creatures that live under the sea, nudibranchs are the most stunning of all of them due to their incredible colours, their beauty and their exotic forms. Also are known as sea slugs and butterflies of the sea due to their undulating way of swimming. They are considered the most beautiful creatures of the sea and as they move very slowly, they are very popular among submarine photographers. Exactly, thanks to these submarine photographers, nudibranchs are so famous and admired by divers and marine naturalists.

Nudibranchs are invertebrates from the *Phylum Mollusca*, which major groups are clams (Class *Bivalvia*), squid and octopus (Class *Cephalopoda*) and snail and slugs (Class *Gasteropoda*). There are more than 7500 molluscs alive today and they arouse on Earth more than 600 millions years ago. During evolution gastropods went through a torsion process that twists the animal head and foot counterclockwise by 180°. So a new anatomical configuration was reached and then the mantle cavity, anus, and gill were positioned over the head, on the unique shell opening. Class *Gastropoda* is divided on three subclasses and *Opistobranchia* (marine slugs) exhibits a major evolutionary trend, the reduction or loss of the shell and a new distortion, aas in Order *Nudibranchia*. There are more than 3000 different species of nudibranchs all over the world. Although the shell is present during their larvae stage, disappears during metamorphosis, so when adults shell is not present. Nudibranchs have gills totally "naked" and secondary respiratory structures called *cerata*. In fact, the word "nudibranch" comes from Latin *nudus* meaning "naked", and Greek *brankhia* meaning "gills". Due to their shell lack, they have not been very known through the history, and actually, Linné in his 12th edition of "*Sistema Naturae*" on 1767 just described 17 species. On 1817 Cuvier described nine new genera and set up the group with that name, Nudibranch. The Englishmen Alder and Hancock created systematic basis of the group at the end of XIX century. But only last years, and thanks to the submarine technology development, study this fascinating animal group has been possible.

ANATOMY AND MORE

Nudibranchs are little marine animals between 3 mm to 15 cm long, though some species can reach 30 cm. They can be very different in shape, but generally are elongated and symmetrical. They are really ephemeral; normally the life span for a nudibranch is one year or less, though some more evolved species can live 3 years. They are benthonic species, living in nearly every marine bottom and can be found all over the world, from Antarctic to tropics, even in our coast. This group can be divided into two main groups, Dorids, with just two structures on its back, a pair of

Berghia coerulescens. Photo by Mikel Cortés Escalante.

rhinophores in the top of the head and a tuff of feathery gills on the back, and Aeolids, also with rhinophores but with the back covered with numerous finger-like appendages called *cerata*. Their small eyes are located below the tissue of the animal on the head near the brain, and they cannot see actual images but only take measures of light intensity. As every molluscs, nudibranchs have a file like organ on the month called *radula*, used to scrap off their food. This organ is covered on top with rows of chitinous teeth, which are produced by the *radula* sac as they are warned down. But the most distinctive characteristic is the pair of tentacles on the head, the rhinophores, chemical sensors used to smell and taste that can be retracted for protection. Dorids have a branchial plume surrounding the anus. These "naked" gills are very irrigated so gaseous exchange occurs. Aeolids have not gills, but *cerata* function as gills. *Cerata* are branching extensions of the digestive system with three functions, breath, digestion and defence. The *cerata* epidermis is so thin that gaseous exchange can occur.

Opisthobranchs are carnivorous feeding on sponges, cnidarians (anemones, soft corals, hydroids, etc.), tunicates, ascidia, bryozoans, and sometimes on algae and even on others nudibranches. Each specie tends to be very selective feeders and may only eat one certain prey species. Thanks to their capacity to digest preys that often are toxic, as sponges or anemones, and even to be able to use these toxic metabolites for their own defence, nudibranchs have been able to feed on those dangerous preys avoiding competence of other predators that will dye due to preys' defence systems. But nudibranchs also have enemies, like spider crabs, some other kind of crabs and fishes. They also can suffer from parasitic copepods.

Chromodoris luteorosea. Photo by Mikel Cortés Escalante.

Sea slugs are simultaneous hermaphrodites, which means that they possess both male and female sex organs at the same time, though auto-fecundation is rare. This strategy increases the probability of finding a mate, since nudibranchs are solitaries and they use to be scattered. Copulation is usually reciprocal, so both function simultaneously as male and female, giving and receiving sperm and both partners will lay eggs. The genitalia are located at the right side of the animal, so for copulating they position themselves opposite side-by-side, subsequently the right sides of their bodies are next to each other. After mating sea slugs lay their spiral egg masses on or near the prey they feed on. Normally eggs are white, though the colour could change and be pink, orange or red depending on diet. Egg development can take between 5 and 50 days, depending on temperature. Usually from eggs arise little planktonic larvae, called *veliger*, with shell, which will lose during metamorphosis, when they begin their benthonic life as adult.

SOPHISTICATE DEFENSIVE SYSTEMS

In most molluscs the shell is the primary defence in which the animal can retreat from danger. But shells are heavy and make difficult to move and slow down growth. So the loss of the shell gave them freedom to evolve spectacularly shaped bodies, they could growth more rapidly and move faster. But sea slugs had to

Chromodoris krohni. Photo by Mikel Cortés Escalante.

evolve a series of strategies to protect themselves from predation. Those amazing, effective and sophisticated defence systems not only reduce death in direct predators' attacks but also have dissuasive effect, which means that enemies that had attack a nudibranch before will not do it again because they remember that bad experience. These defence systems, real chemical and biological weapons, could have been either a post-adaptation to shell loss, either a pre-adaptation that made the shell loss possible.

One of the easiest defence strategies is escape. Some nudibranchs have evolved muscular foot that can secrete mucus to be able to escape, sometimes even swimming, though never very quickly. But they also present some other defences like tubercles that vary in size, shape and number and calcareous spicules in the mantle tissue that can heart the enemy. There are a number of species that have evolved the ability to drop parts of their body, which can be rapidly regenerated, to confuse predators and escape. This behaviour is called autotomy.

Other species have developed colour patterns entirely for defence against predators, mainly fishes. The first line of defence is to try to become invisible. In some cases both the texture and the colour of the body of the nudibranch match the colour and the texture of the prey or the substrate they live on. It is called cryptic coloration. Nudibranchs can obtain the pigments from their diets, though sometimes they can produce pigments themselves. Their translucent body permit the digestive system to be seen and also nutrients that travel through it. In many cases, slugs can vary their colour as they change the food source.

Chromodoris krohni. Photo by Mikel Cortés Escalante.

Some other nudibranchs have a bright and spectacular colour patterns. These colours are used to warm potential predators that these animals are full of distasteful chemicals and not worth to attempting to eat. This is known as aposematic colouration. Even have the ability to change their colours when danger. Normally these slugs contain distasteful or even toxics compounds and one a fish has attacked one nudibranch it is not likely to forget this odd experience, which will correlate with this colour pattern, and will not attack it again. Nudibranchs can obtain the pigments from their diets, sponge or cnidarians, or even they can produce *de novo* themselves. Sometimes different species, both toxics, have evolved similar colour patterns to "help" predators to remember their danger. This is known as Müllerian mimicry. But in other cases, a non-toxic specie evolved the toxic specie's colour pattern to confuse and to avoid been attacked by predator. This is known as Batesian mimicry.

But usually nudibranchs have a chemistry or biological active defence. Sometimes slugs possess skin glands that secret toxic products, like sulphuric acid. In some cases these compounds are known to be toxics and can kill animals near them, but in other cases they are not so toxics but still enough repellents to confuse predators. But the sophisticatest defence system is known cleptodefence. Slugs are evolved to be immune against other invertebrate defences, swallow them and transport them along

Chromodoris purpurea. Photo by Mikel Cortés Escalante.

tracts to the cerata, where they are used for defence, being replaced every few days. Some species are able to use really toxic compounds from sponges and accumulate them in some glands ready to be used if is in danger. Some others, like aeolids, fed on cnidarians (hydrozoans, corals, anemones, jellyfish, etc.) that content cnidocytes, sting and toxic cellules with nematocysts used to defence themselves from predators. To avoid them, some aeolids are able to secrete mucus, which change with cnidarian species, and that inhibits nematocyst discharge. Other species acquire the mucus from the cnidarian and trick their prey. Once the aeolids eat them, cnidocystes are transport and stored in cnidosacs in the tip of their dorsal cerata ready to be used.

Discodoris atromaculata. Photo by Mikel Cortés Escalante.

Crimora papillata. Photo by Mikel Cortés Escalante.

Defence compounds of nudibranchs present biological activity, and are being investigated to be used against some really dangers disease like cancer.

NUDIBRANCHS IN OUR AQUARIUMS?

These colourful and exotic creatures are categorically inappropriate for casual keeping. It is more advisable to admire these animals from the photographs that divers take directly under the sea.

Most sea slugs are either very difficult or impossible to keep in small private aquariums. They are very delicate to ship and sensitive to acclimation. Their diets are very specific, and, as much species are toxics, after dying, there is a very real danger that, due to their decomposition, some toxic compounds could be released into the aquarium and disturb or even kill other organisms.

Discodoris rosi. Photo by Mikel Cortés Escalante.

Doriopsilla areolata. Photo by Mikel Cortés Escalante.

If these advices do not frightened the future keeper, a long quarantine and then to limit their number and mass in the system are recommended. Normally, nudibranchs are peaceful and, because sea slugs are toxic animals, usually they are very active by day. They are not gregarious and, as they are hermaphrodites, there will not be any problem to find the right mate. But before buying our specimen it is of paramount importance to know all its needs, especially diet, and buy it on or with the food it eats, that can be algae, sponge, anemone, coral, worms, etc. It is needed too to be able to find its food or to culture it. Also it is essential to select for a healthy and active specimen, because a sick one will die and dissolve quickly and release its toxic compounds in our aquarium.

Eggs. Photo by Mikel Cortés Escalante.

Flabellina babai. Photo by Mikel Cortés Escalante.

Once the healthy specimen has been chosen, the animal must be quarantined at least for one month. In isolation, information about the animal, specially its diets, must be verified. Nudibranchs are able to live long time, weeks even months, without eating, so if you cannot confirm that the animal is eating

Janolus cristatus. Photo by Mikel Cortés Escalante.

Eubranchus farrani. Photo by Mikel Cortés Escalante.

during quarantine, do not send the animal to the aquarium. Many aquarists on seacoasts may be able to collect nudibranchs, which is further better than ship and stress the animals. Above all, you will have the opportunity to verify the specific food they eat and collect together, and also pick up more in the future. But do not forget to investigate local regulations first.

Little is known about nudibranchs and even less about their diets. Some of them are fed on sponge, others on anemones, even corals, and few on algae. A lot of sea slugs are very specific in their diets and just eat one sponge or cnidarian's specie. So before buying a nudibranch, their diet must be known, and you must be able to give it to the animal, buying the prey or culturing it, or do not buy nudibranchs at all. In recent years, Scientifics have discovered that some nudibranch species are fed on nuisance organisms in the aquarium, like *Berghia verrucicornis* that eats pest anemone *Aiptasia*, *Chelinodura* sp. that eats flatworms, or Lettuce slugs *Elysia* spp. that eats algae.

Due to its extraordinary diversity and distribution in habits of the world's sea, there are not standardized water parameters for the sea slugs and they are very different for each specie. For tropical species, for example, stable and high Redox, high-saturated oxygen levels, and very stable salinity are required. Medications in the form of metals, organics dyes and other products like some kind of antibiotics are not safe to use.

Flabellina pedata. Photo by Mikel Cortés Escalante.

Beyond any issues of stress from feeding, compatibility or acclimation, we will find that sea slugs' life expectancy is really short and they will die within months naturally. Normally they are collected as adult and few live more than a year. After their sudden death, their toxic compounds will be released on our aquarium. To reduce the danger, good chemical filtration like carbon changed weekly, adequate water flow, skimmer and ozonation, and huge water changes will be needed.

So, it is understandable that there are many reasons for leaving these beauties in the sea.

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Hypselodoris cantabrica. Photo by Mikel Cortés Escalante.

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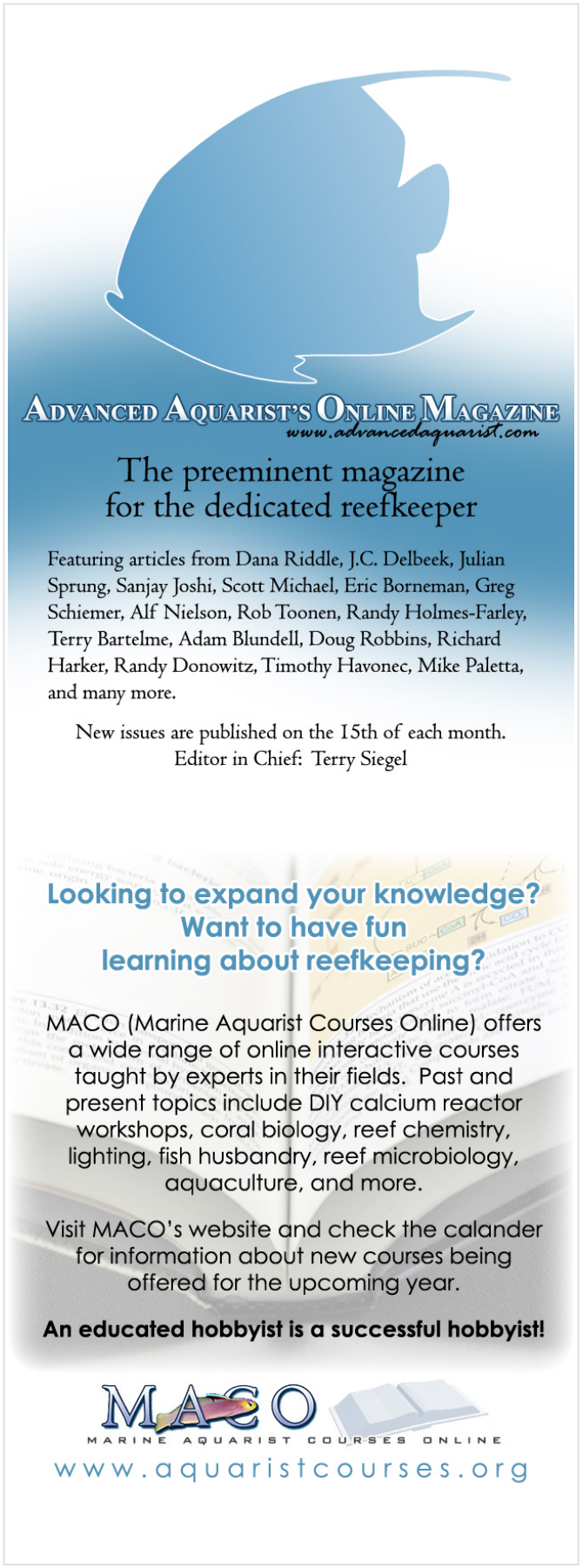
Hypselodoris cantabrica. Photo by Mikel Cortés Escalante.

Hypselodoris tricolor. Photo by Mikel Cortés Escalante.

Polycera quadrilineata. Photo by Mikel Cortés Escalante.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REEFKEEPING EVENTS

What's Happening in Your Area?

By Advanced Aquarist Readers

Check to see if an event is happening in your area!

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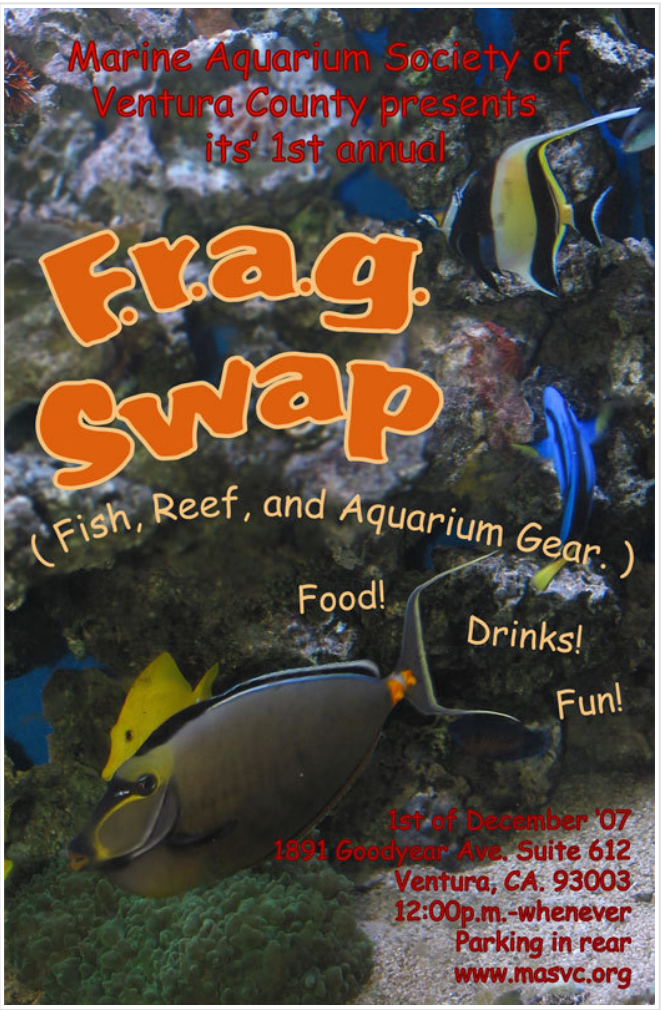
Marine Aquarium Society of Ventura County, California First Annual F.R.A.G. Swap

Date: December 1, 2007
Time: 12:00 PM
Place: 1891 Goodyear Avenue, Suite 612, Ventura CA 93003
Website/Contact Information: http://www.masvc.org

Remember the days when everyone brought coolers full of corals, burgers and dogs were cooked to perfection by volunteers, people talked about our hobby over frosty beverages (responsibly of course), and you left feeling like you truly scored some great stuff? We believe it's possible to bring back that great vibe!



On December 01 (12:00pm) we will open the doors to a 2,000 sq. ft. warehouse for some good old fashioned frag swapping. We're trying our best to keep this event like the classic frag swaps of past.

Here's what you can count on from this event:

- Great prizes raffled off after Brad (our President of Vice) finishes each beer!
- All the burgers, dogs and chips you can eat (please consider a $3 donation to our club).
- SPS, LPS, Zoanthids, Hardware and just about anything else you could want for your aquarium!
- Great deals!! (What's the point in a swap if you can have it delivered to your door from the latest Ultra-Mega-Reef-Farm-Warehouse-Superstore for less?)
- A wonderful time!!

We need your help!!

- We need some of the local growers/backyard hobbyist who are dedicated to promoting this hobby because they love it and want to share (you know who you are).
- We need people to contribute to a potluck because Reefers cannot survive on burgers and dogs alone.
- Spread the word! This IS the BEST way to stock your tank!

Amenities:

- A warehouse with electrical outlets galore!
- Free WI-FI (PayPal!!)
- Ray promises to raffle off a full-body seaweed and wheat germ wrap to one really lucky prize winner!!
- PLENTY of Free parking

Please note: There will be limited commercial vendor space so please PM (private message) any of the following MASVC members for details at MASVC.org:

- blown63chevy
- abendx
- docdave
- cayecaulker

If you've ever wanted to attend a classic frag-swap, want to sell/trade some coral or hardware, or just want to hang out with people who have similar interests, come by. Everyone is welcome!!

The Manhattan Reefs Fall Frag Swap

Date: Sunday December 9th
Time: 10AM – 6PM
Place: Pace University, NY
RSVP Required
Website: Manhattan Reefs

Guest Speakers:

- Dr. James Fatherree
- Dr. James Cervino

And as usual, admission includes:

- Manhattan Reefs Frag Auction
- Reef Pest Inspection Station
- Equipment demonstrations
- Livestock vendors
- Several group buys
- Food, snacks, soft drinks
- Baggies, rubber bands, warmed saltwater

Due to University security requirements, you MUST preregister by RSVPing. You must pay in advance, no tickets will be sold at the door.

Hope to see you there!

Marine Aquarium Expo, Saturday, April 5 and 6, 2008

The First Annual Marine Aquarium Expo (MAX) is a TWO DAY EVENT at the Orange County Fair & Exposition Center (Costa Mesa, CA) April 5-6 2008!

Dates and Times:

- Saturday, April 5th 12:00 noon to 8:00 PM
- Sunday, April 6th 10:00 AM to 6:00 PM
- Calendar Information

Event Information:

- Over 100 exhibitor's booths!
- Manufacturers, Wholesalers, Retailers, Exhibitors
- Livegoods/Drygoods for sale throughout the building
- 8 major Speakers lined up! (4 per day)
- Multiple Workshops and Demonstrations
- Children's Petting Pool and education area (pending)
- Frags! Frags! and more Frags! need I say more?

Admission: Adults $10.00, Seniors $5.00, Children 12 & under are Free!

MAX is held in Building #12, (22,000 sq. ft. fully-enclosed, air-conditioned exhibit hall). An adjoining 7,000 sq ft. covered courtyard will host much of the peripheral activities (speakers, workshops, raffles, seating area, etc.). This greatly enhances the space available inside building 12 for commerce. In other words: More room for everyone!

HUGE RAFFLE at the end of each day! Special Note: 50% of ALL Raffle Proceeds will go to 10 select public charities, all of whom are participating in MAX either directly or indirectly. (some represented by hobbyists doing a workshop on behalf of the charity)

This is a VERY family-oriented event, so please plan on bringing the entire family for a weekend of spectacular exhibits, speakers, workshops, displays, and other entertainment. Great food, clean restrooms, even a seating area.

Ladies and Gentlemen, this event is expected to attract over 3,000 hobbyist from all over the United States! Participating vendors and attendees alike are coming from all parts of the country. In fact, MAX is soon to become the largest event of its kind in the entire North American continent in terms of overall attendance. You don't want to miss this one!

For more information, visit us at: http://www.marineaquariumexpo.com

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(please note: MAX is not affiliated with any club organization)

International Marine Aquarium Conference '08, May 30-June 1, 2008

Just Imagine...a weekend where you can see live presentations by the most widely known, well-respected authors and lecturers in the marine aquarium hobby.

At the International Marine Aquarium Conference the speakers will be covering all the latest information and research on marine aquarium fish, corals and invertebrates. Meet with them socially, see exhibits by some of the foremost manufacturers and dealers in the aquarium hobby, and get some great deals on conference specials.

IMAC is open to ALL hobbyists . You do not have to belong to a marine aquarium society or even own a reef tank to attend, just be interested in learning more about this fascinating hobby. IMAC is a non-profit venture by hobbyists for hobbyists to insure the continuation of an annual educational event for aquarists, at a reasonable cost.

Whether you are a seasoned aquarist or just a beginner, IMAC is something you need to take in. And IMAC is put on each year by the same people, so if you attended IMAC in 2003, 2004, 2005, 2006 or 2007 you know the high quality of the show that we will put on.

IMAC 2008 will take place in Chicago, Illinois, USA - May 30, 31 and June 1 at the Crowne Plaza Hotel, Chicago IL:

Crowne Plaza Hotel, Chicago O'Hare
5440 North River Road
Rosemont, IL 60018, USA

For more information, visit http://theimac.org/ or contact Dennis Gallagher.

MACNA XX, September 5-7, 2008

Presented by Atlanta Reef Club and MASNA, MACNA is the largest hobbyist marine conference in North America. New aquarium products, vendors will often wait until MACNA to release new products into the hobby. Hobby professionals, you will have a chance to meet and mingle with professionals in the hobby like Eric Borneman and Anthony Calfo. A chance to be at a conference with hundreds of other people just as obsessed with aquariums as you are.

We have selected the Westin Peachtree Plaza as the host hotel for this event. It is the tallest hotel in the western hemisphere. Our negotiated room rate is $119.00 per night with discounted parking. Everyone that stays in the hotel will be given free internet access from their rooms.

This 73-story tower, topped by the revolving Sun Dial Restaurant, Bar & View, graces the heart of Atlanta. Connected to AmericasMart, The Westin Peachtree Plaza, is steps from CNN, Georgia Aquarium, Georgia World Congress Center and the Georgia Dome.

Contact Information:

MACNA XX
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LATERAL LINES

MIND THE GAP, PART I: A GLOWING EXAMPLE

By Adam Blundell, M.S.

My position was that the many groups involved in the hobby were not working directly with each other and far more could be done.

Published November 2007, Advanced Aquarist's Online Magazine.

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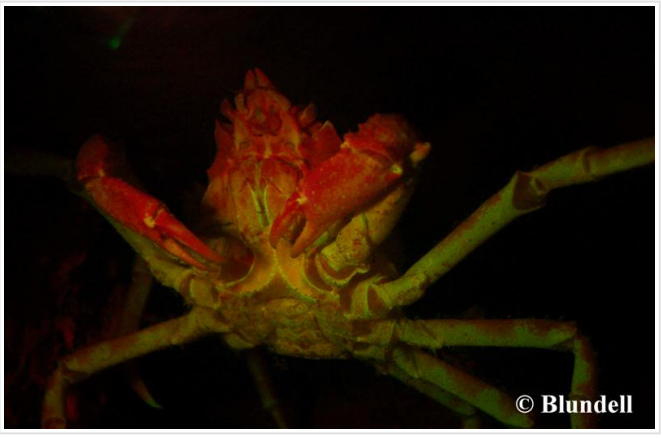
During the Marine Ornamentals conference of 2004 I presented a lecture… more like a challenge… to the attendees to "bridge the gap" as I say. The basic concept of my lecture was to draw attention to the varying aquarium hobby constituents and their separation. More important than their separation is the idea of removing that separation.

In general this means seeing research scientists get their findings directly into the hands of hobbyists, seeing those hobbyists request specific animals from retailers, which in turn causes a shift in collection sites. Along those lines collection sites can provide invaluable information to research scientists on the natural settings of these animals. My position was that the many groups involved in the hobby were not working directly with each other and far more could be done.

BACKGROUND

Who is Adam Blundell? Adam Blundell is the bridge. After challenging people within the industry to work together I set out to serve as an example. My whole life has been spent as a hobbyist. My career has been research, and now education. With the laboratory I operate and the articles that I publish, I hope to bridge the cap between the research science world and the hobbyists world. I hope it is working… and it appears to be working.

On July 11th 2006 I received an email from Miss Erin Hisrich, an intern at the Mystic Aquarium and Institute for Exploration (which I refer to as the Mystic Aquarium) in Mystic Connecticut. Erin had been looking for information on coral fluorescence and her search was most difficult. She couldn't locate many sources of info on coral fluorescence in captive aquaria. Her main source of information happened to come from an article I wrote here for Advanced Aquarist Online Magazine (Blundell 2005). That email seemed to start it all (queue the dreamy music used in movies for flashbacks).



This photograph was taken at the Mystic aquarium using fluorescent filters.

THE EXHIBIT

After several emails and a few phone calls between me and the Mystic Aquarium staff the project idea seemed plausible. It was time for me to make my way to the aquarium (about as far across the country from me as possible). I visited with the staff and presented general information on fluorescence, and more importantly fluorescence within the aquarium hobby. After that it was time for the fluorescent guru to take charge. Dr. Charles Mazel (www.nightsea.com) is amazing. He has pioneered the study of coral fluorescence and delivered the information to the hobbyists. Many thanks to Dr. Mazel; I wish we had more people like him.

You see I said this whole thing started when I received that email from Miss Hisrich. But in fact it began much earlier. Dr. Mazel has been working with coral fluorescence for years. He is a true

Shown here Marzena Blundell is using NightSea fluorescent equipment to locate minute marine organisms.

research scientist. He wanted to share his work and finding with the hobbyists and did so with a breakout presentation at the International Marine Aquarium Conference (IMAC) in 2004. His presentation was "enlightening" to say the least. It was my first opportunity to meet Dr. Mazel in person. From that point on I've been in contact with him, and have been using his stellar products. Needless to say I owe my studies, my publications, and the Mystic Aquarium owes their exhibit, to this man.

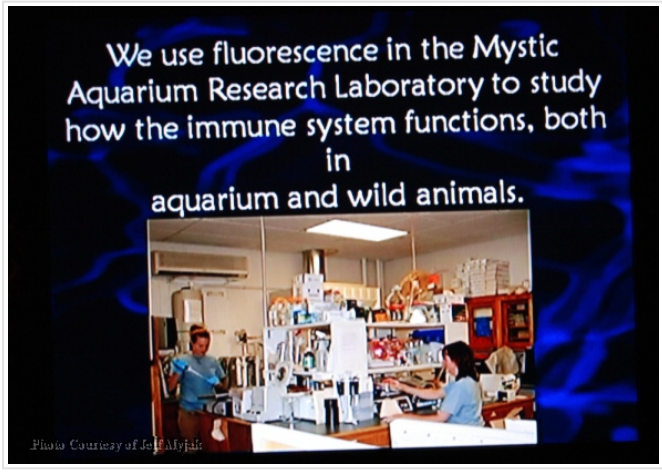
Conclusion

Where to begin? Let me begin by thanking Jeff Myjak of Enfield, CT. Jeff has been a great help in providing photographs for this publication. The opening of the fluorescent exhibit at the Mystic Aquarium and Institute for Exploration is beacon of hope for what can be done. This project utilized the scientific studies of Dr. Mazel, the hobbyist work of Adam Blundell, the public outreach efforts of the Mystic Aquarium, the vision of William "Bill" Kelly (Mystic Aquarium's first president) and the desire of one person to bring it together. Congratulations Erin. I'm so pleased to see an exhibit that showcases the wonders of life. Forget the part about it being about fluorescence, the impressive part is seeing how well all the gaps were bridged to bring about this project.

For more information, or to plan your visit to this exhibit please visit www.mysticaquarium.org.

Shown here is the entrance to Mystic Aquarium and Institute for Exploration.

Adam Blundell presenting information on fluorescent animals and the equipment used to see this phenomenon.


We use fluorescence in the Mystic Aquarium Research Laboratory to study how the immune system functions, both in aquarium and wild animals.
Photo Courtesy of Jeff Myjak

In the future, scientists hope to use fluorescent Zebra Fish as pollution detectors by developing a fish that will only fluoresce if it's in polluted water.
Proposed future use:
Clean Water
Polluted Water
Photo Courtesy of Jeff Myjak

THE WILLIAM E KELLEY GALLERY
Fluorescent Corals
Reefs in Danger !
What is Fluorescence
Fluorescence in Your Daily L
Photo Courtesy of Jeff Myjak

Shown here are the entrance to the new exhibit, and a couple photographs of displays within the exhibit. Photos provided by Jeff Myjak.

Dr. Charles Mazel and Adam Blundell

Author Information

Adam Blundell M.S. works in Marine Ecology, and in Pathology for the University of Utah. He is also Director of The Aquatic & Terrestrial Research Team, a group which utilizes research projects to bring together hobbyists and scientists. His vision is to see this type of collaboration lead to further advancements in aquarium husbandry. While not in the lab he is the former president of one of the Nation's largest hobbyist clubs, the Wasatch Marine Aquarium Society (www.utahreefs.com). Adam has earned a BS in Marine Biology and an MS in the Natural Resource and Health fields. Adam can be found at adamblundell@hotmail.com.

References

1. Blundell, A., (2005) "The Seen and Unseen World of Coral Fluorescence", Advanced Aquarist Online Magazine, http://www.advancedaquarist.com/2005/2/lines, USA.

2. www.NightSea.com Dr. Charles Mazel's website which is filled with information on aquatic fluorescence.

ONLINE COURSES

Marine Aquarist Course Schedule for 2008

By D. Wade Lehmann

Marine Aquarist Courses Online (MACO) will be offering a whole host of new educational courses for you starting in January 2008!

Published November 2007, Advanced Aquarist's Online Magazine.

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Previous topics have covered everything from the science behind light and lighting to manual construction of acrylic and wood items.

This coming year will offer a host of new, never seen before courses that include:

Reef Microbiology – This course will cover the basics of nutrient flux, bacterial presence and colonization, and focus in tightly to what has been published in the scientific literature recently. The design of the course is such that anyone can learn the details of microbiology as it relates to aquarium maintenance. This course will last for 6 weeks and start in January 2008.

Reef Chemistry – Also on offer starting in early 2008, reef chemistry! This course starts at the beginning and builds a scientific base upon which all aquarists can stand. Topics include alkalinity, acid-base relationships, and even the more complex buffering system in marine aquaria. If you want to know more about why your alkalinity is so low, and what that really means… this is the course for you! This course will last for 6 weeks.

Digital Reefkeeping – How to take images, create webspace (blogs, webpages, photo sharing, etc) on your own! Learn how to create and manage your own domain name and set up an awesome webspace for yourself.

Fish Husbandry – This 8 week course gets into the nitty gritty of culturing, maintenance and the biology behind the fish we keep. Check it out!

Aquaculture in Practice – This course will detail how to culture various living items for your tanks. Everything from algae to zooplankton, this course will cover the details for anyone who wants to learn more about maintenance of a more natural state by growing live foods.

Sounds great, but how does MACO work?

MACO is a web-based instructional website run by instructors who have intimate knowledge of the course they are teaching. Courses are primarily run online via weekly chat sessions, interactive course materials, reading assignments and discussions, and many other avenues just like in a real classroom course, but on your own time! Even if you can't make a weekly chat session in person, the transcripts from the session will be available to you. Course participants get permanent access to their course on the website and a private forum to post questions to allow users to get to know each other. Instructors can be contacted by email, via the forums, or at the chat sessions during the course to answer your questions or assist you in any way. The website is always available, so the readings and other information can be picked up at any time.

Head over to the Marine Aquarist Courses (http://www.aquaristcourses.org/) website for complete details

Want to see your ideas in print?
Advanced Aquarist wants to hear from you!
Do you have a marine-related topic that you'd like to share with others or that you think the marine aquarium hobby might be interested in? If so, why not write for us? We offer very competitive pay rates and your article will be published both online and in PDF for others to read.
Contact our Chief Editor, Terry Siegel, at terry@advancedaquarist.com and get started!

WHAT IN NEPTUNE'S WORLD

What in Neptune's World?

By Terry Siegel

Guess the mystery coral.

Published November 2007, Advanced Aquarist's Online Magazine.
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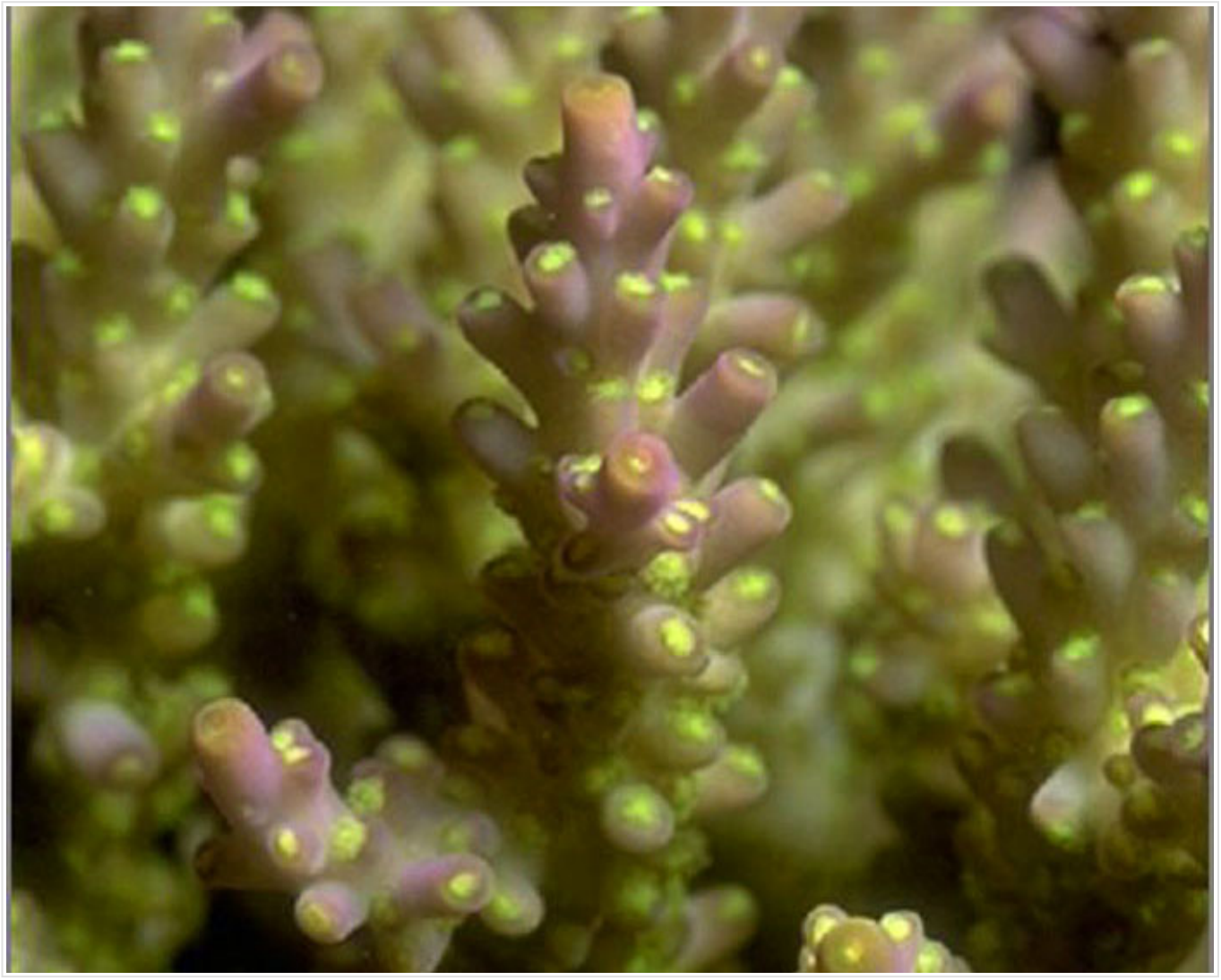
Welcome to **"What in Neptune's World"** - a column intended to explore the wonders of the coral reefs in an entertaining, interactive manner.

This month, we have a mystery coral seeking identification. Can you identify it?

Feel free to discuss the possibilities with other hobbyists in this thread in the Reefs.org's General Reef Discussion Forum.



Can you identify this coral?

PRODUCT REVIEW

Spectral Analysis of Aquarmckzo and Catalina Metal Halide Lamps

By Sanjay Joshi

Sanjay presents spectral data on a low cost bulb found on EBay and data on the Catalina lamps.

Published November 2007, Advanced Aquarist's Online Magazine.

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This article presents an analysis of the Aquarmckzo and Catalina metal halide lamps. The lamps tested along with the ballasts used are shown in Table 1 below. The Aquarmckzo lamps were sent to me by a reefs.org member. These lamps are being sold on ebay for around $10. At this price it definitely increases the curiosity to determine the type of value these lamps represent. The Catalina Reef Grow series of lamps are sold by Catalina Aquarium (www.catalinaaquarium.com).

Table 1: List of lamps and ballasts tested

	175 Watt	250 Watt	400 Watt
Lamps	Catalina 15000K	Aquarmckzo 10000K Aquarmckzo 14000K Catalina 15000K	Aquarmckzo 14000K Aquarmckzo 20000K
Ballasts	Magnetic (M57) Icecap (electronic) Lumen General (Electronic)	PFO-HQI (ANSI -M80) IceCap (Electronic) Blueline (Electronic) Reef Fanatic (Electronic) EVC (Electronic) Icecap –New (Electronic)	PFO-HQI Taiwan HQI EVC (Electronic) Icecap (Electronic) Coralvue (Electronic) Magnetic (M59) Blueline (Electronic)

Comparision of Lamp Performance Under Different Ballasts

This section presents the results of testing the different lamps using different ballasts. For each lamp tested different ballasts were used to fire the lamp and data is presented for the unshielded and shielded case. Spectral data is only provided for the shielded case, since we feel that most lamps will be used in this manner.

Aquarmckzo 250W DE 10000K

Table 2: Aquarmckzo 250W DE 10000K

Ballast	Power	Voltage	Current	Unshielded		Shielded	
				PPFD	CCT	PPFD	CCT
HQI – M80	349	122.4	3.05	166.1	6458	137	6230
Reef Fanatic	258	123.7	2.22	112	6956	92.2	6771
Icecap - New	263	123.7	2.25	116.1	6832	95.5	6562
Blueline	252	123.5	2.15	110.4	7051	90	6940
EVC	263	122.3	2.37	116.3	6608	95.3	7049
Icecap	253	121.6	2.33	111.6	7090	91.3	6820

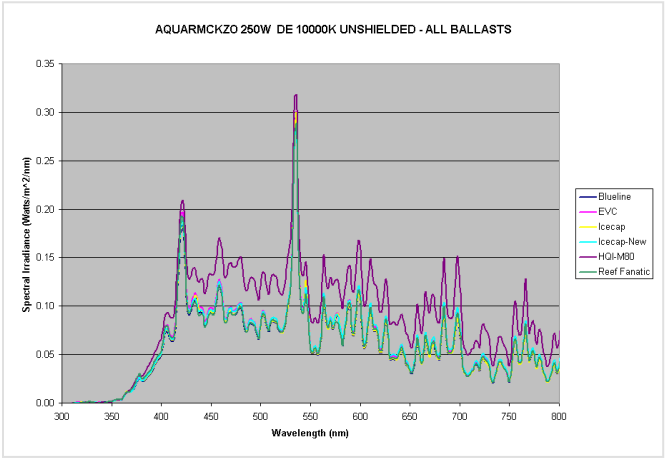

Figure 1: Spectral Plot of the unshielded Aquarmckzo 250W DE 10000K Lamp with the different ballasts

AQUARMCKZO 250W DE 14000K

Table 3: Aquarmckzo 250W DE 14000K

Ballast	Power	Voltage	Current	Unshielded		Shielded	
				PPFD	CCT	PPFD	CCT
HQI – M80	322	121.8	2.92	62	7217	51.3	6903
Reef Fanatic	258	122.7	2.23	55.4	10498	44.4	9213
Icecap - New	264	122.4	2.28	46.4	7135	37.9	6666
Blueline	252	122.7	2.18	52.4	10537	42.4	9495
EVC	263	120.9	2.31	48.2	7804	38.8	7303
Icecap	252	123.2	2.28	54.1	8836	36.8	8199

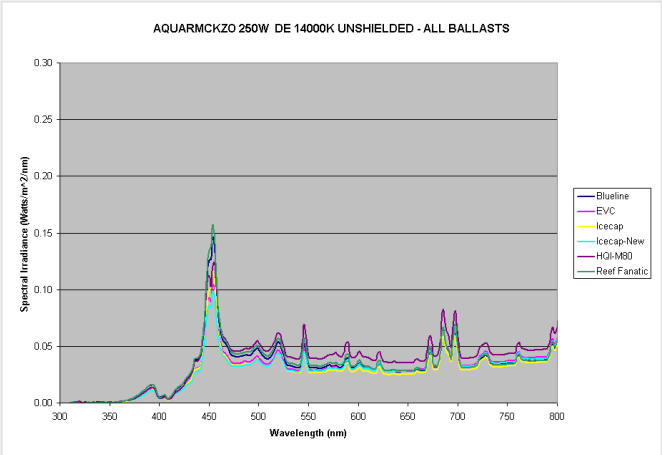

Figure 2: Spectral Plot of the unshielded Aquarmckzo 250W DE 14000K Lamp with the different ballasts

CATALINA 250W DE 15000K

Table 4: Catalina 250W DE 15000K

Ballast	Power	Voltage	Current	Unshielded		Shielded	
				PPFD	CCT	PPFD	CCT
HQI – M80	302	122.3	2.74	59.7	-	48.6	67272
Reef Fanatic	256	122.7	2.23	57.3	-	46	-
Icecap - New	263	122.9	2.27	60.8	-	46	-
Blueline	250	122.3	2.17	53.9	-	39.1	-
EVC	262	122.8	2.27	57.2	-	46.7	-
Icecap	250	123.2	2.31	47.6	-	39.1	-

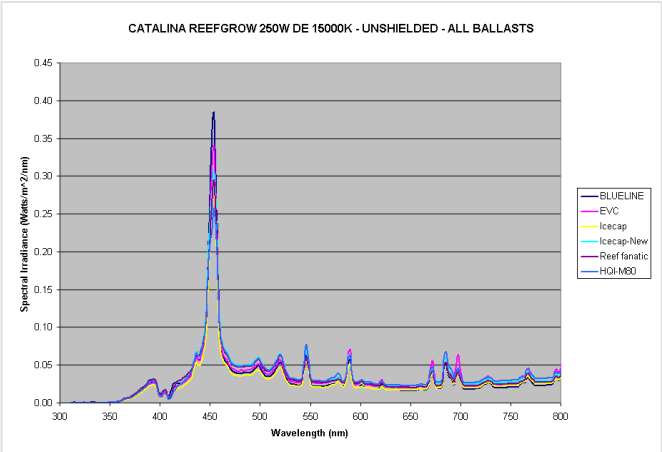

Figure 3: Spectral Plot of the unshielded Catalina 250W DE 15000K Lamp with the different ballasts

AQUARMCKZO 400W MOGUL 14K

Table 5: Aquarmckzo 400W Mogul 14K

Ballast	Power	Voltage	Current	PPFD	CCT
Icecap	432	122	3.68	62.8	31024.8
Blueline	388	121.9	3.34	64.7	-
EVC	422	122.2	3.62	65.2	57329.8
Magnetic (M59)	378	122.2	3.65	62	-
Taiwan-HQI	442	122	3.92	93.9	-
PFO-HQI	524	121.4	4.95	123.7	30519

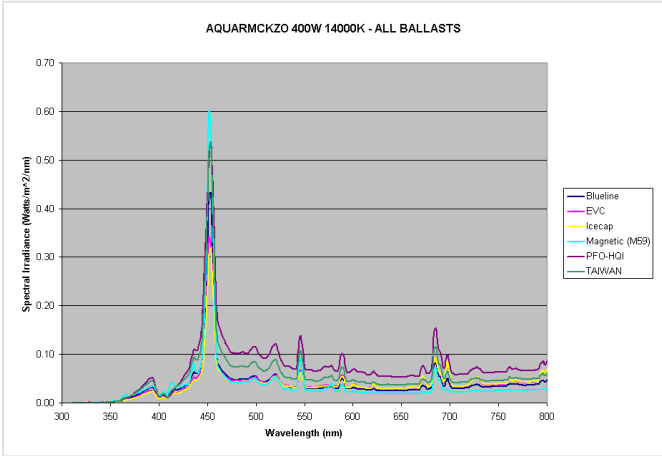

Figure 4: Spectral Plot of the Aquarmckzo 400W Mogul 14K Lamp with the different ballasts

AQUARMCKZO 400W MOGUL 20000K

Table 6: Aquarmckzo 400W Mogul 20000K

Ballast	Power	Voltage	Current	PPFD	CCT
EVC	423	121.8	3.65	74.4	52462
Icecap	431	121.4	3.72	76	55272
Blueline	392	121.4	3.38	69.7	-
PFO-HQI	516	121.5	5.33	103	17614
Taiwan-HQI	444	122.2	3.9	88.4	-
Magnetic (M59)	436	123.5	3.98	75.7	-

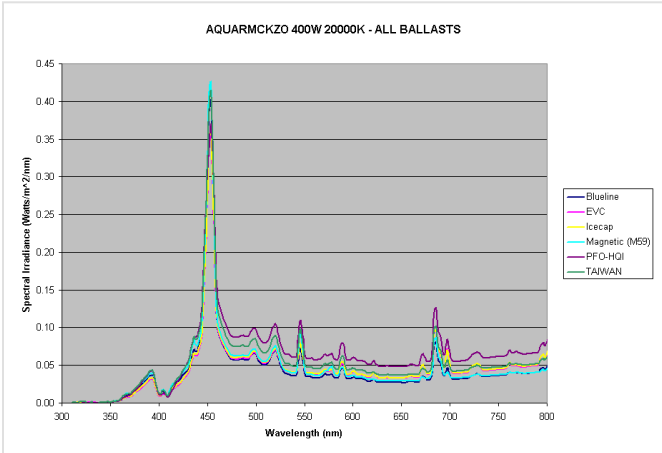

Figure 5: Spectral Plot of the Aquarmczo 400W Mogul 20000K Lamp with the different ballasts

CATALINA REEFGROW 175W MOGUL 15000K

Table 7: Catalina ReefGrow 175W Mogul 15000K

Ballast	Power	Voltage	Current	PPFD	CCT
Magnetic (m58)	185	123.1	2.04	27.8	-
Icecap	179	122.3	1.64	38.8	-
Lumen General	179	121.9	1.65	39	-

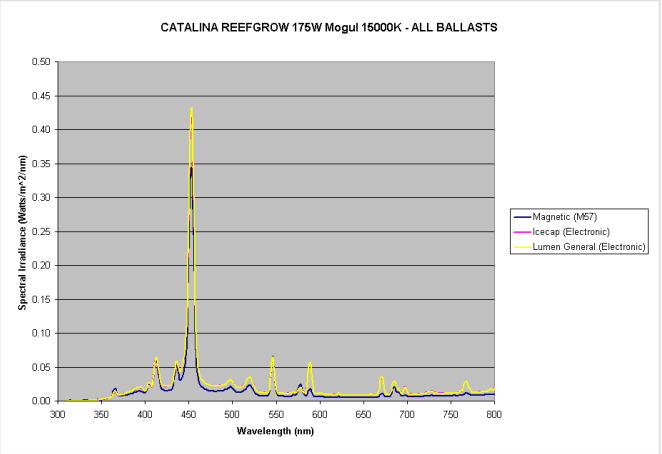

Figure 6: Spectral Plot of the Catalina ReefGrow 175W Mogul 15000K Lamp with the different ballasts

DISCUSSION

Fig 7, 8 and 9 and show how these lamps compare in PPFD values to all the other lamp and ballast combinations tested over the last few years. The data for all the lamp ballast combinations is grouped into categories (6500K, 10000K, 12000-18000K, and 20000K as specified by the lamp manufacturer's ratings) and plotted on a chart showing the complete range of PPFD output for a given class of lamps.

Fig. 7 shows all the data for 175W mogul lamps, and superimposed on it is the data for the Catalina 175W Mogul 15000K lamp. As seen from the chart, the PPFD values for Catalina 15K lamp falls in the bottom third of all the lamps tested in the 12000-18000K range. Furthermore, the spectral plot for this lamp indicates that it will appear very blue since it has a spectral plot similar in profile to the lamps sold as 20000K. This lamp tends to perform better with the electronic ballasts. Comparing the output to 20000K lamps shows that this lamp performs around the middle of the range of the 20000K lamps.

Figure 8, shows the comparison of the Acquarmckzo 250W DE 10000K and the 250W DE 140000K lamp against all the other 250W DE lamp and ballast combinations previously tested. Interestingly, the 10000K 250W DE lamp tested has quite high output when compared to the others in its class, especially on the HQI-M80 ballast. The performance with the other ballasts is quite good and compares well with other lamps. The tested correlated color temperature is in the 6200-7000K range, which is very similar to a lot of the 10000K lamps. The 14000K 250W DE lamp on the other hand is a very poor performer when compared to lamps in its class. Spectrally this lamp has a higher correlated color temperature than the 10000K lamp, but the output is significantly low.

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The Catalina 250W 15000K DE lamp has a spectral output more similar to the 20000K rated lamps, and as seen in the chart the output is quite low compared to the lamps in the 12000-18000K range.

Figure 9, shows the comparison of the Acquarmckzo 400W 14000K and 20000K lamps against all the other 400W mogul lamp and ballast combinations previously tested. The best performance of the 14000K lamp on the PFO HQI ballast puts it in the middle of the pack, and on other ballasts the performance is quite poor. However, once again the 14000K lamp has a spectral plot that is quite similar to the 20000K lamp, and if compared to the other 20000K lamps the output is quite comparable to lamps in the lower middle of the pack.

Conclusion

When compared against other lamp and ballast combinations, these lamps tend to have lower output. However, this does not mean that the lamps are not useable. Given the low cost of the lamps, their use can be justified. Knowing that the output lies in the lower half to the lower third of comparable lamps, this information can be used to extract the most out of these lamps.

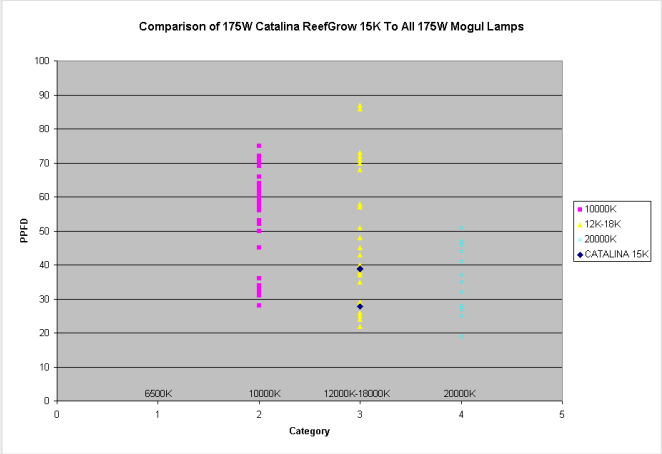

Figure 7: Comparison of the PPFD of Catalina ReefGrow 175W Mogul 15000K Lamp to all other 175W lamps and ballast combinations.

For example, these lamps could be adequate if you could mount them lower and use them on shallower tanks, or with corals that require lower light levels.

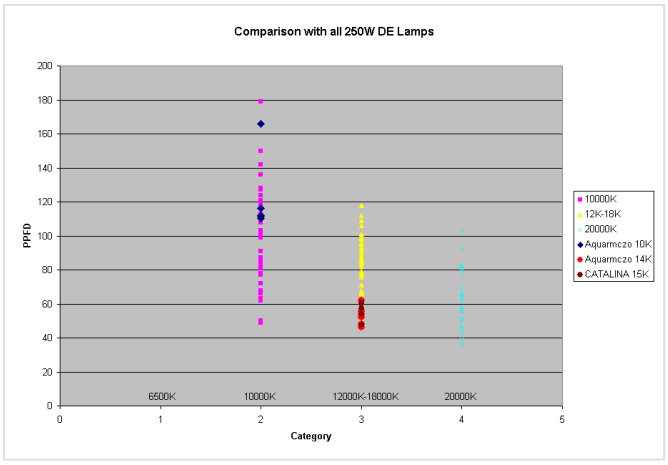

Figure 8: Comparison of the PPFD of unshielded Aquarmckzo 250W 10000K, 140000K DE Lamp and Catalina 250W DE 15000K to all other 250W DE lamps and ballast combinations.

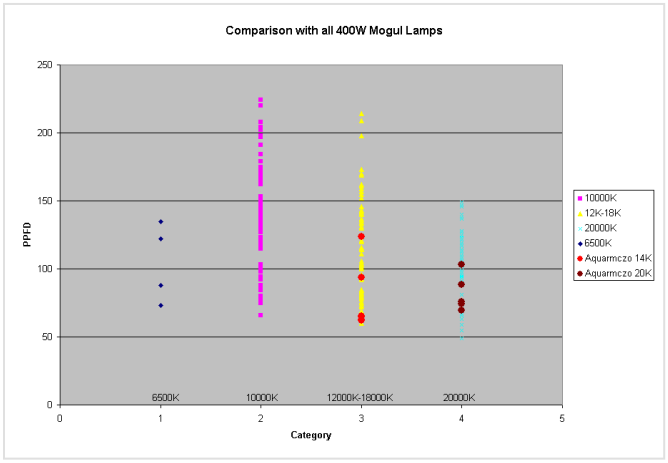

Figure 9: Comparison of the PPFD of Aquarmckzo 400W 14000K, 20000K DE Lamps to all other 400W DE lamps and ballast combinations.

HOT TIPS

Tips for Growing or Making your Own Tank Food

By Advanced Aquarist's Readers

This month, our readers give tips on food recipes for their tank.

Published November 2007, Advanced Aquarist's Online Magazine.

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A selection of useful tidbits of information and tricks for the marine aquarist submitted by Advanced Aquarist's readership. Readers are encouraged to post them to our Hot Tips sticky in the Reefs.org General Reefkeeping Discussion forum or send their tips to terry@advancedaquarist.com for possible publication. This month's Hot Tip theme is "Christmas Wishlist and Why You Want and/or Need It."

Hot Tips: Tips for Growing or Making your Own Tank Food

Here is one way to make your own food for your reef tank.

- ~2 c. Uncooked, de-shelled fresh shrimp
- ~1/2 c. Uncooked, frozen "white" fish (any type of non-fatty, white ocean fish is good... flounder, whitefish, etc)
- ~1/2 c. Uncooked, fresh mussel or clam or oyster or combination
- 1 full sheet Nori (unsalted, unspiced, dried)
- 1 tsp Selcon (Selco)
- 1 tsp lemon juice (to preserve and provide vitamin C)
- Many other items can be thrown in for variety. A mixture of prepared retail foods is common, brine shrimp, greenwater, vitamins, etc. Just be certain to use high quality foods.

To prepare the food, keep out ~1/2 c of the shrimp, combine all others except nori in a blender. Add fresh saltwater (or microwave (to boiling) some tank water to use) and blend until smooth. Add nori, chop, but don't completely blend into oblivion. Chop remaining shrimp into small pieces by hand, ~1-4mm in size, add to the mash and combine, but don't blend thoroughly. *If the blend is too thick, add more salt water. Another option is to add concentrated phytoplankton (such as DTs).*

Spoon/pour the mash into individual ziplock baggies (usually 4-6 of them) and lay flat in the freezer (I use a baking pan until they are semi-solid to prevent them from being really thick in spots). Be careful not to make it too thick in the baggies as its hard to break apart later. This keeps it in a few batches that should last if well sealed.

To use the food: Break off (typically can snip off pieces, if its not too thick, by hand) and defrost the food in a cupful of tank water. You can either leave it whole and let the fish tear it apart or do as I do and create a snowstorm out of it by allowing it to defrost and then using a turkey baster to break it all apart in the cup. All of the various particle sizes allow all of your animals (corals and detritivores) to feed.

Submitted by: Wade

For many other ideas, please take a look at this search on Reefs.org.

Or search Google for ideas.

ONLINE NEWS

Reefs in the News

From Online News Sources

Media coverage of the state of our world's reefs, interesting information, and other marine-related news.

Published November 2007, Advanced Aquarist's Online Magazine.
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Federal government sues ship owner, pilot in SF Bay oil spill (San Francisco Chronicle)

National Marine Sanctuary in the News
November 30, 2007 09:43 PM

The federal government on Friday accused a ship pilot and the owners of the container ship Cosco Busan of breaking environmental laws when the ship struck a bridge support in San Francisco Bay, spilling 58,000 gallons of toxic oil. The Justice...

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http://us.rd.yahoo.com/dailynews/rss/search/%22National+Marine+Sanctuary%22/SIG=13aum8s26/*http%3A//www.sfgate.com/cgi-bin/article.cgi?f=/n/a/2007/11/30/financial/f121417S24.DTL&feed=rss.business

Officials remove oil from sunken ship (San Francisco Chronicle)

National Marine Sanctuary in the News
November 30, 2007 05:06 PM

Officials removed 370 gallons from a commercial fishing boat that hit the rocks and sank off Pigeon Point early Thursday morning, according to the U.S. Coast Guard. The agency contracted Parker Diving Service to remove the oil, which authorities feared could...

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Reef key to disease fight (The Courier Mail)

Yahoo! Coral Reefs News
November 30, 2007 01:00 PM

AN underwater treasure trove of new species found off the Queensland coast could hold the key to miracle cures for hundreds of diseases.

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Santa Cruz fishing crew wrecks near Pigeon Point (Santa Cruz Sentinel)

National Marine Sanctuary in the News
November 30, 2007 10:15 AM

PIGEON POINT -- The night was dark, maybe a bit stormy and something struck the starboard side of Leo Morelli's crab fishing boat as he and his son checked their crab pots just south of Pigeon Point.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/%22National+Marine+Sanctuary%22/SIG=12b1p4lke/*http%3A//www.santacruzsentinel.com/story.php?storySection=Local&sid=51159

Moss Landing, Marina bird deaths believed to be linked (Santa Cruz Sentinel)

National Marine Sanctuary in the News
November 30, 2007 10:14 AM

As the number of seabirds sickened or killed over the past three weeks in Santa Cruz and Monterey counties surpasses 750, officials say they believe incidents in Moss Landing and Marina that caused near- and off-shore birds to lose their waterproofing were both likely caused by the ongoing red tide.

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http://us.rd.yahoo.com/dailynews/rss/search/%22National+Marine+Sanctuary%22/SIG=12bjpmto7/*http%3A//www.santacruzsentinel.com/story.php?storySection=Local&sid=51160

Seasonal seas may help coral reefs survive global warming (ANI via Yahoo! India News)

Yahoo! Coral Reefs News
November 30, 2007 08:21 AM

Washington, Nov 30 (ANI): A new study has found that corals might survive rising ocean temperatures in 'tough love' seas with wide-ranging temperatures. Coral reefs are composed of tiny creatures that live in colonies in mostly tropical and subtropical waters. Corals are home to beneficial algae, which gives reefs their stunning colors. During prolonged, unusually high surface ...

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=11il9400k/*http%3A//in.news.yahoo.com/071130/139/6nw8a.html

More than 400 Indonesians evacuated after ferries hit reef: official (Antara News)

Yahoo! Coral Reefs News
November 30, 2007 07:40 AM

More than 400 Indonesians were evacuated to safety from two ferries that plunged into a coral reef off Sulawesi island on Friday, a rescue official said.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=13h1dqsap/*http%3A//www.antara.co.id/en/arc/2007/11/30/more-than-400-indonesians-evacuated-after-ferries-hit-reef-official

'Young guns' of coral reef research head downunder (University of Queensland)

Yahoo! Coral Reefs News
November 30, 2007 06:14 AM

A worldwide network of the next generation of leading coral reef scientists and managers is set to meet for the first time at The University of Queensland (UQ) in Brisbane on December 10-14, 2007.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=11mlhvf10/*http%3A//www.uq.edu.au/news/index.html?article=13573

UM student discovers new fish (The Miami Hurricane)

Yahoo! Coral Reefs News
November 30, 2007 12:05 AM

When an oceanographer traveled to a coral reef atoll off of Mexico's Yucatan Peninsula in 2006 to study how the environment affects fish populations, he solved another scientist's 25-year-old mystery.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=136g3nlp3/*http%3A//www.thehurricaneonline.com/news/2007/11/29/News/Um.Student.Discovers.New.Fish-3122424.shtml

Study finds seasonal seas save corals with 'tough love' (PhysOrg)

Yahoo! Coral Reefs News
November 29, 2007 09:43 PM

Finally, some good news about the prospects of coral reefs in the age of climate change. According to a new study by the Wildlife Conservation Society, corals may actually survive rising ocean temperatures in â€˜tough love` seas with wide-ranging temperatures.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=11d7589el/*http%3A//www.physorg.com/news115576326.html

Fontes awarded for coast care (Whitsunday Times)

Yahoo! Coral Reefs News
November 29, 2007 09:15 PM

TONY and Beverly Fontes of the Order of Underwater Coral Heroes (OUCH) have been awarded a prestigious Coastcare Local Hero medal for their outstanding contribution to repairing and protecting the Whitsunday s magnificent coast.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=1497juv4f/*http%3A//www.whitsundaytimes.com.au/localnews/storydisplay.cfm?storyid=3756916&thesection=localnews&thesubsection=&thesecondsubsection=

Life IN THE depths (Bangkok Post)

Yahoo! Coral Reefs News
November 29, 2007 07:06 PM

One might think that an aquarium is a place for children, but a visit to Bangsaen Institute of Marine Science of Burapha University might change your mind.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=123n14iqu/*http%3A//www.bangkokpost.com/291107_Horizons/29Nov2007_hori07.php

Hurricane Season Comes to a Close

NOAA Government News Releases
November 29, 2007 03:58 PM

Fourteen named storms formed in the Atlantic Basin this season â€" of which six became hurricanes, including two major hurricanes. While the U.S. was spared the seasonâ€™s worst, Central America was hit by two destructive Category 5 hurricanes.

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Source:
http://www.noaanews.noaa.gov/stories2007/20071129_hurricaneend.html

Toxin From Coral-reef Bacteria Could Become Next-generation Cancer Drug (Science Daily)

Yahoo! Coral Reefs News
November 29, 2007 03:07 PM

Researchers have acquired a new molecular tool that could help them transform a toxin from coral-reef bacteria into a next-generation cancer drug. They uncovered new functions for an ancient, well-known family of proteins found in many organisms, from microbes to humans.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=121tftmq3/*http%3A//www.sciencedaily.com/releases/2007/11/071128103345.htm

Research vessel damages reef, does not report incident (The Miami Hurricane)

Yahoo! Coral Reefs News
November 29, 2007 01:06 PM

A University of Miami marine research vessel crashed into a coral reef in Biscayne National Park on Oct. 13, but the crew did not notify authorities, said Jennifer Johnson, a U.S. Coast Guard spokesperson.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=13u7u9v93/*http%3A//www.thehurricaneonline.com/news/2007/11/29/News/Research.Vessel.Damages.Reef.Does.Not.Report.Incident-3122432.shtml

No rescue from state, feds for birds at Farallones, Monterey Bay (San Francisco Chronicle)

National Marine Sanctuary in the News
November 29, 2007 09:36 AM

Federal and state wildlife officials have decided to ignore two large groups of contaminated birds, saying they lack resources to rescue the Farallon Islands victims of the recent San Francisco Bay oil spill as well as hundreds of birds injured in an...

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/%22National+Marine+Sanctuary%22/SIG=12rk6tg5t/*http%3A//www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2007/11/29/MN3ETKP1C.DTL&feed=rss.news

Coral Reefs Living In Sites With Variable Temperatures Better Able To Survive Warm Water

ScienceDaily: Coral Reef News
November 29, 2007 05:00 AM

Finally, some good news about the prospects of coral reefs in the age of climate change. According to a new study corals may actually survive rising ocean temperatures in 'tough love' seas with wide-ranging temperatures.

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Source:
http://www.sciencedaily.com/releases/2007/11/071129183829.htm

Hawaii Superferry to resume service (USA Today)

National Marine Sanctuary in the News
November 29, 2007 01:05 AM

The 866-passenger Hawaii Superferry will resume service between the islands of Hawaii on Dec. 6 after a bruising legal and legislative fight.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/%22National+Marine+Sanctuary%22/SIG=12hsvv36r/*http%3A//www.usatoday.com/news/nation/2007-11-28-hawaii-superferry_N.htm?csp=34

Indonesia's Corals Threatened by Climate Change (Planet Ark)

Yahoo! Coral Reefs News
November 28, 2007 08:55 PM

JAKARTA - It is a country with some of the world's richest coral reefs. But scientists fear many of Indonesia's pyschedelic reefs, already significantly damaged by blast fishing and pollution, now face an even graver threat: global warming.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=126mimo30/*http%3A//www.planetark.org/dailynewsstory.cfm/newsid/45598/story.htm

Tranquil Area of Cancun is Home to Laid-Back Luxury, Culture, and Eco-Exploration (Business Wire via Yahoo! Finance)

Yahoo! Coral Reefs News
November 28, 2007 04:08 PM

CANCUN, Mexico----Vacationers to Mexico's Yucatan peninsula can experience a recipe of relaxation and exploration in the quiet village of Puerto Morelos, an area of Cancun located just 12 miles south of the International Airport.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=11rtnubie/*http%3A//biz.yahoo.com/bw/071128/20071128005752.html?.v=1

Whale Groups Appreciate Volunteer Aid to Manage Vessel Strikes (Newswise)

National Marine Sanctuary in the News
November 28, 2007 02:26 PM

With three reported whale deaths by ship strike last summer, the Whale and Dolphin Conservation Society (WDCS) and other New England-based conservation groups have been faced with increased management pressures. Meeting the challenge are local volunteers--collaborating with researchers and federal authorities--to give whale protection added buoyancy.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/%22National+Marine+Sanctuary%22/SIG=12l8c36mv/*http%3A//redirect.alexa.com/redirect?www.newswise.com/articles/view/535697/?sc=rssn

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HelloLights

HelloLights has been in business since 1997 providing the aquarium industry with high quality lighting products and accessories. Throughout the years, our mission has been to be the aquarium hobbyist? one stop source for all of their lighting needs. With unsurpassed customer service and high quality products, we truly believe we are the clear choice for aquarium lighting. We realize that lighting is one of the major purchases that the hobbyist will make when setting up an aquarium, and we take great pride in our role in this process.

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MarineDepot.com is the current leader in supplying marine and reef aquarium supplies. We simply try to make as many people (including both our staff and our customers) as happy as possible. We found that we have been able to accomplish this by maintaining extremely low prices, providing friendly customer service, and simply liking what we do.

Premium Aquatics

Premium Aquatics is a family owned and operated aquarium business. We have been in business since April 1996 and we are dedicated to serving the aquarium hobbyist. Our mission is to bring you the highest quality aquarium products and livestock available and at a reasonable price and to provide honest non-bias information on all of our products and our competitors. Our goal is customer satisfaction, we want your return business.

The Coral Broker

The Coral Broker has fantastic LPS, SPS, Soft, Rare and Exotic and Live Corals and Clams at affordable prices. Our live corals come from around the world. We get weekly shipments from Jakarta, Fiji, Tonga, Australia, etc. We provide the ultimate corals at prices you can afford, even without one of our amazing sales.

Two Part Solution

The Two Part Solution is a method of adding calcium, alkalinity and magnesium to your reef aquarium. What's unique about this solution is many of the items used are household items or just bulk supplies of the very same products you are buying two cups of for $20 just because it has a fancy package. It has been time tested by thousands of aquarists and proven to not only be incredibly effective and easy to use but also extremely affordable. There is simply no other balanced calcium, alkalinity and magnesium solution out there that is so ridiculously cheap and has no expensive and intimidating equipment to buy.

AquaC Protein Skimmers

AquaC, Inc. was founded in 1998 as a small one-man operation that focused on providing exceptional products and stellar customer service. Since that time, the company has rapidly developed into one of the fastest growing marine filtration manufacturer's in the industry. Although we now offer a variety of product lines and manufacture thousands of units each year, our focus remains the same - quality products and top-notch customer service.

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Deltec USA

Deltec aquarium equipment is renowned throughout the world for its high performance and superior quality. Deltec has been in the marine aquarium business for more than 20 years in Europe, and developed the pinwheel more than 19 years ago.

Southern California Caulerpa Action Team

An important goal of the Southern California Caulerpa Action Team is the detection of undiscovered infestations of C. taxifolia or other invasive species of Caulerpa, and the prevention of their spread.

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Sunlight Supply, Inc.

Sunlight Supply Inc. is a manufacturer and importer of High Intensity Discharge (H.I.D.) and fluorescent lighting fixtures. We specialize in fixtures with applications in the hobby & commercial horticulture and reef tank aquarium industries. Sunlight Supply Inc. is a recognized and respected leading brand in the marketplace.

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Marine Aquarium Expo is southern California's premier indoor consumer tradeshow, bringing together manufacturers, retailers, and saltwater enthusiasts into one centralized location.

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AquariumPart.com is an online retailer of many hard to find parts for various aquarium lights, pumps, protein skimmers, meters, UV sterilizers and filters.

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